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Study of neonatal gastric aspirate related to amniotic fluid and to the occurrence of the idiopathic respiratory distress syndrome

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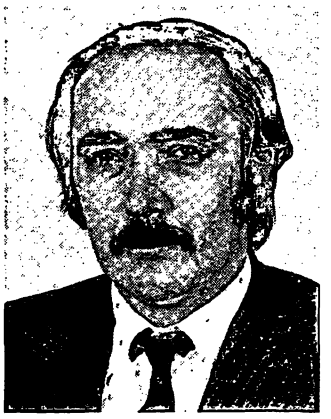
1 Introduction

Newborn infants, particularly preterm infants, are prone to develop the idiopathic respiratory distress syndrome (I.R.D.S.). The clinical syndrome is characterised by tachypnoea > 60 min with intercostal and sternal recession and an expiratory grunt. Chest radiographs reveal a reticulogranular appearance with an air bronchogram. The condition is due to a deficiency of surface active phospholipids necessary to maintain alveolar stability [1]. The presence of surface active phospholipids can be assessed antenatally by measurement of the lecithin/sphingomyelin ratio (L/S) of amniotic fluid and this has been used extensively in the antenatal prediction of the development of I.R.D.S. [9, 13]. A more rapid test, the shake test, has also been developed and shown to be useful [4].

These tests have been applied postnatally to gastric aspirate [3, 7, 5], tracheal aspirate [2, 6, 11] with varying success. In the past twelve months we have studied infants born in the Royal Maternity Hospital with three objectives in mind. The primary objective was to determine to what extent amniotic fluid L/S ratio was reflected in gastric aspirate L/S ratio. The second objective was to correlate gastric aspirate L/S ratio with I.R.D.S. and to determine if there was any value below which the occurrence of I.R.D.S. could be confidently predicted.

Curriculum vitae



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2 Methods

Amniotic fluid was obtained at anterior amniotomy and gastric aspirate was obtained as soon as possible after delivery, always within the first hour. Samples containing blood or meconium were discarded. The remaining samples were centrifuged and stored at – 20 °C until analyses were performed.

The biochemical procedure used follows that outlined by GLUCK and his associates [10]. The phos-

pholipids are first extracted in chloroform and methanol. After evaporation to dryness cold acetone is used to precipitate the surface active phospholipids, which are redissolved in chloroform and then separated by thin layer chromatography. Areas were determined using a BEHRINGWERKE immunoelectrophoresis plastic measuring scale. I.R.D.S. was diagnosed by one of us (G.McC.) using the parameters given above and without knowledge of the L/S ratios.

3 Results

3.1 Relation between amniotic fluid L/S ratio and gastric aspirate L/S ratio

The results of 66 paired samples of amniotic fluid and gastric aspirate are shown in Fig. 1.

Two points are noted. **The gastric aspirate L/S ratio is generally higher than the amniotic fluid L/S ratio. The range in value for gastric aspirate L/S ratio for any given amniotic fluid is wide.** The regression coefficient of this graph is $y = 0.82\,x + 0.77$ when y = gastric aspirate L/S ratio and x = amniotic fluid L/S ratio. The r value is 0.758.

3.2 Correlation between gastric L/S ratio and I.R.D.S.

One hundred and ten babies who had gastric aspirate obtained at birth were studied. The results are shown in Table I.

Tab. I. Relation of gastric aspirate L/S ratio to I.R.D.S.

L/S ratio	No. samples	No. of patients with I.R.D.S.
> 2.0	93	1
1.5–2.0	14	6
< 1.5	3	3

Of 93 babies who had a gastric aspirate L/S ratio > 2.0, only one developed I.R.D.S. This infant's gastric L/S ratio was 2.1, the clinical condition was mild and the infant required oxygen therapy only.

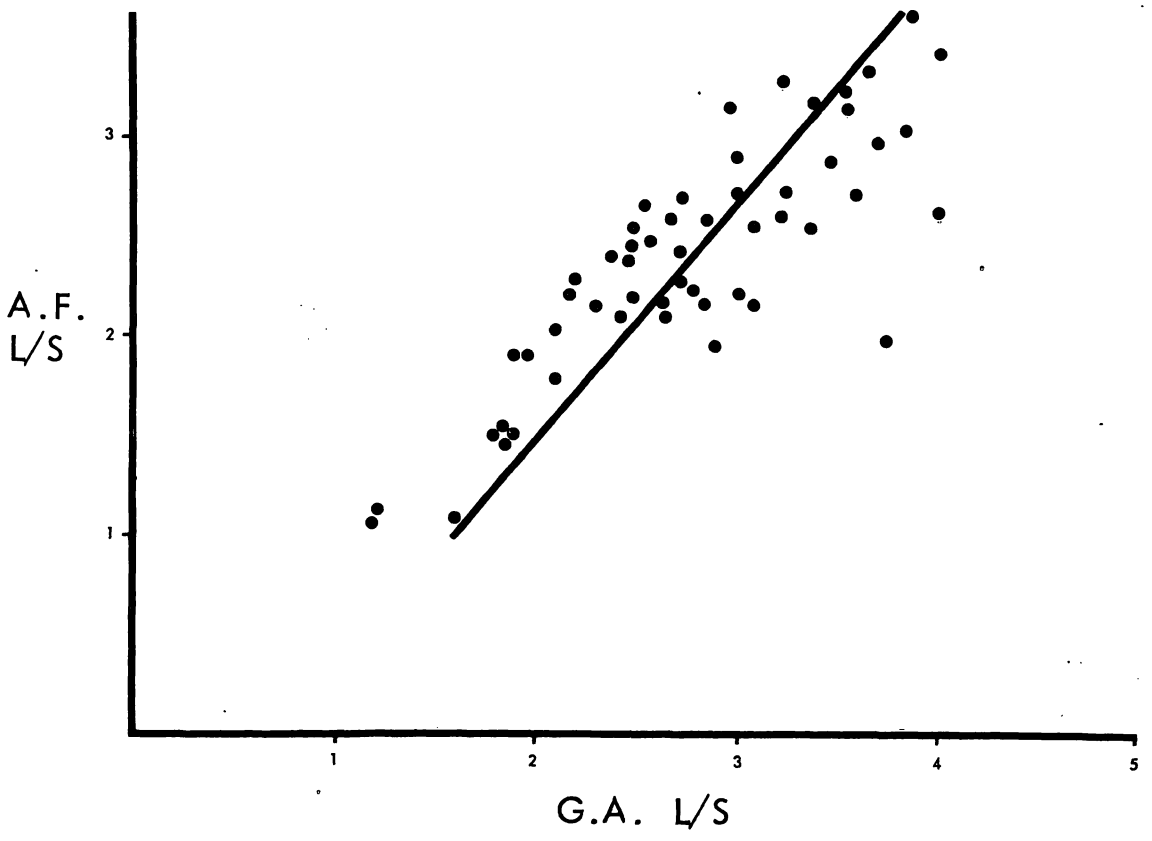

Fig. 1. L/S Ratio in 66 paired samples of amniotic fluid and gastric aspirate.

In 14 babies the gastric aspirate L/S ratio was between 1.5 and 2.0 inclusive. Of these, 6 babies developed I.R.D.S. The individual results of ratios in this group are given in Table II.

Tab. II. Intermediate zone gastric L/S ratios

IRDS positive	IRDS negative
1.95	1.94
1.91	1.86
1.87	1.77
1.71	1.76
1.65	1.70
1.6	1.68
	1.68
	1.62

In 3 babies, the L/S ratio was < 1.5. All 3 infants developed severe I.R.D.S.

These results indicate that I.R.D.S. can be predicted from the estimation of the gastric aspirate L/S ratio (for Tab. I $p < 0.001$; $\chi^2 = 25.0$).

4 Discussion

Our results indicate that there **is broad agreement between amniotic fluid and gastric aspirate L/S ratios**, as previously indicated by us [12]. That the correlation is not closer is not surprising since, although the gastric aspirate of newborn infants comprises mainly swallowed amniotic fluid, this is not the sole component. It would appear that some other factor interferes to an extent with either the lecithin and sphingomyelin or their measurement in gastric content. This interference is not sufficient to alter the predictive value of the gastric L/S ratio in our series. These findings differ from the results of DUDENHAUSEN, KYNAST and SALING [6] who could find no relationship between the total lecithin concentration of amniotic fluid and gastric aspirate. The contradiction may be due to the differences in the methods employed.

There is a close correlation between the gastric L/S ratio and the development of I.R.D.S. This conforms the findings of others [3]. In our study, infants who have an L/S ratio in excess of 2 are very unlikely to develop I.R.D.S. whereas the three infants with a ratio of < 1.5 all developed severe I.R.D.S. There is a transitional zone between 1.5 and 2.0 where an infant may or may not develop I.R.D.S. These results correspond closely with previous work on amniotic fluid performed in our hospitals by WHITFIELD [13]. Infants whose L/S ratios fall in the transitional zone require further investigation to determine why they do or do not develop I.R.D.S.

Summary

The lecithin/sphingomyelin ratio (L/S) has been shown to be of use in the prediction of the idiopathic respiratory distress syndrome (I.R.D.S.) when performed on amniotic fluid.

Gastric contents at birth consist mainly of amniotic fluid. Our study was designed to determine what the relationship was between the L/S ratios of amniotic fluid and gastric aspirate obtained at birth and to examine whether the L/S ratios of gastric aspirate was of any value in the prediction of I.R.D.S.

Method

L/S ratios were measured in amniotic fluid obtained at anterior amniotomy and on gastric aspirate obtained at birth. Sixty-six paired samples were obtained.

In 110 babies the gastric aspirate L/S ratio was measured and the presence or absence of I.R.D.S. was determined by clinical and radiological parameters.

Results

We found that there is **broad agreement between the amniotic fluid and gastric aspirate L/S ratios.** The gastric aspirate L/S ratio is generally slightly higher.

The relation between gastric aspirate L/S ratio and the occurrence of I.R.D.S. is significant (Tables I and II). Infants whose gastric aspirate L/S ratio was < 2 are extremely unlikely to develop I.R.D.S. Those whose ratios lie from 1.5 to 2.0 inclusive may develop I.R.D.S. and in our series, all of the small group with L/S ratios < 1.5 developed severe I.R.D.S.

Key Words: Amniotic fluid, distress syndrome, gastric aspirate, idiopathic respiratory, L/S ratio.

Zusammenfassung

Untersuchungen über den neonatalen Magensaft und das Fruchtwasser sowie über das Auftreten eines idiopathischen Atemnotsyndroms

Es konnte gezeigt werden, daß der im Fruchtwasser bestimmte Lecithin-Sphingomyelin-Quotient (L/S) von Nutzen ist für die Voraussage eines idiopathischen Atemnotsyndroms (I.R.D.S.). Der Magensaft nach der Geburt besteht vorwiegend aus Fruchtwasser. Unsere Studie hatte das Ziel festzustellen, welche Beziehung zwischen der L/S-ratio im Fruchtwasser und im aspirierten Magensaft, der bei der Geburt gewonnen wurde, besteht. Ferner sollte untersucht werden, ob der L/S-Quotient im aspirierten Magensaft irgend einen Wert hat hinsichtlich der Voraussage eines I.R.D.S.

Methodik

Der L/S-Quotient wurde im Fruchtwasser, welches durch vorangehende Amniocentese gewonnen worden war und im Magensaft, der postpartal aspiriert wurde, bestimmt. 66 Probenpaare wurden gewonnen. Bei 110 Babys wurde der L/S-Quotient im Magensaft gemessen und die An- oder Abwesenheit eines I.R.D.S. durch klinische und radiologische Parameter festgelegt.

Ergebnisse

Wir fanden, daß eine breite Übereinstimmung zwischen dem Fruchtwasser-Quotienten und dem L/S-Quotienten im Magensaftaspirat bestand. Der L/S-Quotient im Magensaft ist generell etwas höher. **Die Abhängigkeit zwischen Magensaft L/S-ratio und dem Auftreten eines I.R.D.S. ist signifikant (Tab. I und II).** Kinder, deren Magensaft L/S-Quotient 2 betrug, hatten ein extrem geringes Risiko ein I.R.D.S. zu bekommen. Neugeborene deren ratio zwischen 1,5 und 2 lag, können ein I.R.D.S. bekommen und alle Kinder der kleinen Gruppe mit einer L/S ratio unter 1,5 entwickelten – entsprechend unserem Datemmaterial – ein schweres I.R.D.S.

Schlüsselwörter: Atemnotsyndrom, Fruchtwasser, L/S Ratio, Magensaft.

Résumé

Etude du contenu gastrique néonatal relativeau liquide amniotique et à l'occurence d'asphyxie périnatale protopathique

On a déjà démontré que le taux de lécithine/sphingomyéline (L/S), établi sur le liquide amniotique, est utile pour prévenir l'asphyxie périnatale protopathique.
Le contenu gastrique à la naissance consiste surtout en liquide amniotique. Notre présente étude a pour but de déterminer la relation entre les taux L/S du liquide amniotique et le contenu gastrique prélevé à la naissance et d'examiner si le taux L/S du contenu gastrique est significatif pour le pronostic de l'asphyxie périnatale.

Méthode: Les taux L/S ont été mesurés dans le liquide amniotique obtenu par amniotomie antérieure et sur le contenu gastrique prélevé à la naissance avec, au total, svixante-six échantillons doubles.
Chez 110 bébés, on a mesuré le taux L/S du contenu gastrique et déterminé la présence ou l'absence d'asphyxie périnatale par paramètres cliniques et radiologiques.

Résultats: Il existe un étroit rapport entre les taux L/S du liquide amniotique et ceux du contenu gastrique qui sont en général légèrement plus élevés pour ce dernier.
La relation entre le taux L/S du contenu gastrique et l'occurence d'asphyxie périnatale est significative (tab. I et II). Un taux L/S du contenu gastrique établi à 2 rend une asphyxie périnatale très improbable; par contre, les taux entre 1.5 et 2.0 laissent ouverte la possibilité d'une asphyxie périnatale, et, dans les cas qui nous concernent, tous les bébés du petit groupe aux taux L/S de 1.5 ont souffert d'une grave asphyxie périnatale.

Mots-clés: Périnatale protopathique, contenu gastrique, liquide amniotique, taux L/S.

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Bibliography

[1] AVERY, M. E., J. MEAD: Surface properties in relation to atelectasis and hyaline membrane disease. Am. J. Dis. Childh. 97 (1959) 517

[2] BLUMENFELD, T. A., J. M. DRISCOLL, L. S. JAMES: Lecithin/sphingomyelin ratios in tracheal and pharyngeal aspirates in respiratory distress syndrome. J. Pediat. 85 (1974) 403

[3] BORER, R. C., L. R. KUHNS, J. F. HOLT, A. K. POZNANSKI, F. T. BEDNAREK: Accuracy of gastric aspirate lecithin/sphingomyelin ratio and chest radiographs in the diagnosis of respiratory distress syndrome. Pediat. Res. 8 (1974) 444

[4] CLEMENTS, J. A., A. C. G. PLATZKER, D. F. TIERNEY: Assessment of the risk of the respiratory

distress syndrome by a rapid test for surfactant in amniotic fluid. N. Eng. J. Med. 286 (1972) 1077
[5] COWETT, R. M., E. J. UNSWORTH, D. O. HAKANSON, J. R. WILLIAMS, W. OH: Foam stability test on gastric aspirate and the diagnosis of the respiratory distress syndrome. N. Eng. J. Med. 293 (1975) 413
[6] J. W. DUDENHAUSEN, G. KYNAST, E. SALING: Vergleich der Lezithinkonzentrationen im Fruchtwasser und Trachealsekret. Perinatalmedizin 6. Deutscher Kongreß für Perinatale Medizin. Thieme Stuttgart 1974
[7] EVANS, J. J.: Prediction of respiratory distress syndrome by shake test on newborn gastric aspirate. N. Eng. J. Med. 292 (1975) 1113
[8] FOX, H. A., L. SARKOSI, W. N. ROSENFELD: Lecithin content in hypopharnygeal mucus of newborn infants. Pediat. Res. 8 (1974) 446
[9] GLUCK, L., E. K. MOTOYAMA, H. L. SMITS, M. V. KULOVICH: The biochemical development of surface activity in mammelian lung. Pediat. Res. 1 (1967) 237
[10] GLUCK, L., M. V. KULOVICH, R. C. BORER, P. H. BRENNER, G. G. ANDERSON, W. N. SPELLACY: Diagnosis of the respiratory distress syndrome by amniocentesis. Amer. J. Obstet. Gynec. 109 (1971) 440
[11] KANTO, W. P., R. C. BORER, D. W. ROLOFF: Postnatal changes in the L/S ratio of tracheal aspirate (TA) from infants with severe respiratory distress syndrome. J. Pediat. 84 (1974) 921
[12] MCCLURE, B. G., E. HICKS, E. GREENE, M. REID: Gastric aspirate lecithin/sphingomyelin ratio. Lancet 2 (1975) 1155
[13] WHITFIELD, C. R., W. B. SPROULE: Fetal lung maturation. Brit. J. Hosp. Med. 12 (1974) 678

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